THE SILO AND SILAGE

Where the Silo Originated--Various Opinions As To Its Value--What Different Styles Cost--How To Plan For and Build a Silo

(Written Specially for The Bulletin)

Ensilage, universally called "silage" for short, is simply canned cow-fodder; canned while the fodder is fresh and sweet with all its natural juices in it.

It bears about the same relation to hay or stover in the mow as a jar of canned fruit does to a string of dried apples.

Now, dried apples are not to be sneezed at. They were regarded by our grand-dads as very much worth while. They are better than no apples when it comes pie-baking time. But certainly they lack the freshness and the juiciness and the flavor and the aroma—in other words the succulence of fresh fruit.

Likewise dried hay and corn-stalks are worth saving. A great many million cattle have lived through the winters on them and have given milk and produced butter. But one needs only to recall the scent of the fresh mown hay fields, the air often heavy with the odors wasting into it from the drying grass, to understand that something which is in the fresh forage, and that something not mere water, is lost from it in the process of curing.

Moreover, every dairyman, whether he have a hundred milkers or just one runt of a Jersey for family supply, knows what a difference there is between the quantity and quality of June milk and January milk. The one is made from fresh forage; the other from dried fodder. It isn't the weather nor the smell of the wild flowers that gives June butter its precedence in the market. It is just the difference in feed. If one could give his milkers the same feed in January which they have plentifully in June, they'd make pretty much the same sort of butter, regardless of weather and temperature.

THE DEMAND FOR SILOS ON THE INCREASE.

This is exactly what the silo filled with fresh silage seeks to accomplish. It doesn't quite do so much. There is some loss in quality no matter how carefully the silage may be ensiloed. But there is vastly less loss than comes from dessication in the open air and under hot July suns. No one pretends that even canned strawberries are every whit as good as fresh ones right off the vines. But they are better than dried apples, all the same. The best silage isn't quite as succulent nor quite as digestible nor quite as well-flavored as the fresh forage out of which it is made. But it has more of all these qualities than it would have if it were dried for the mow or stack.

Therefore it is becoming if it has not already become the main stay of many of the largest and most successful dairies in the land.

One could hardly climb a hill of any height anywhere in New England or New York and look over the surrounding country without seeing in plain sight the conical roofs of anywhere from two to a dozen silos.

Strange to say, the usually progressive west was slowest to take to the innovation. Twenty years ago, a silo west of the Alleganies was a curiosity. But things are different, now. Recently in a Wisconsin farm paper I saw the statement that in a certain county which had but three silos in use five years ago, about ninety were now filled and more than thirty more were planned for next season. They are coming to be almost as characteristic a feature of prairie landscapes as of New England hillsides. As is usual in other things, moreover, the western farmer, who jumps with both feet when he jumps at all, is already ahead of the eastern average in the size and importance of his silos. There are farms in the Corn Belt where already the silo capacity is said to be greater in cubic feet than their total barn capacity.

And yet, in neither east nor west has the silage tide reached anywhere near its flood. Very rarely has one, once tried, been given up, while the demand for new ones keeps busy more than a dozen companies engaged in furnishing material and erecting them. For every dairyman who discards his silo a hundred others erect new ones.

OBJECTIONS RAISED TO SILAGE.

Of course there are some objections to the use of silage. Nothing wholly and absolutely good has yet been discovered in farming. One argument which has been used against the silo is its original cost. In the early days, when silos were mostly built of brick or stone, this was a more serious matter than at present. The modern silo is usually constructed of staves—sometimes, when exceptional strength and endurance are desired, of reinforced concrete. It is quite possible to get a fairly good idea of the cost of such structures. The average cost of 25 stave silos, constructed in different parts of the country in the past few years, each of 100 tons capacity or less, was $118.40. The average cost of 71 concrete silos of similar capacity, was $220.47. Any farmer can figure for himself whether he could build a barn big enough to store a hundred tons of dry fodder for any such amount.

Another objection which has been raised is that corn, which is the crop generally raised to furnish silage, contains too small a proportion of protein for a well-balanced ration. This is undoubtedly true. But the deficiency, such as it is, can easily be compensated for in the dry forage and grain which should always be fed with any ration. If clover or alfalfa are grown they will pretty nearly even things up. Indeed, some have believed it possible to make a balanced ration by mixing clover, alfalfa or cowpeas with the corn when filling the silo. This, however, is discouraged by the experienced. They find that the legumes are liable to rot unless a good deal of extra care is taken to pack the silage of which they are a part. And, as some dry forage should always be fed, it has been found better to dry such materials rather than convert them into silage.

At one time it was believed that silage-fattened cattle shrunk more than others in shipping to market. This idea has been proved without basis. A like impression among some that prime carcasses cannot be made from silage is quite as untrue. The evidence gathered from thousands of cases goes to show that "there is no appreciable difference in the percentage of marketable beef that steers will dress out which have been finished on a silage ration and a dry ration. The meat seems equally bright and the fat as well intermixed with the lean."

Another objection which was raised at one time lay in the belief that silage-fed cattle had to be protected from the cold more than those given dry fodder and grains. Experience indicates that there isn't much basis for this. All cattle do better with some protection from cold winter winds and rains and with a dry place to lie down. But artificially warmed barns are no more necessary to silage-fed stock than to any other. In fact, the evidence goes to show that fat cattle make larger and cheaper gains in open sheds than when confined in close barns.

At one time, the argument against the silo, when it was held by many to be just one more "new-fangled" idea, was in what might be called the "pickles" stage. "I don't want my cows to eat pickles," was the slogan. There is no gainsaying that much of the early silage made turned out more or less sour. This was due rather to inexperience in building and filling the silos than to the process itself. Now that we know how to make a silo air-tight and how to cut the silage so it will pack itself into an impervious mass, there is little talk of "sour pickles." While generally there is a slight odor from it when freshly thrown out, this odor is not apt to be offensive either to man or beast. Indeed, anyone who has seen a long row of stanchioned heads thrust forward and heard the impatient mooing which broke out like a chorus the moment the animals smelt the silage being taken out for them, would well be warranted in assuming that both odor and taste were attractive to them.

Similarly, the idea held at one time that silage "tainted" the milk is fast being discarded. There are still those who advise that it be fed only after milking, in order to avoid any such danger. But others feed it, the same as they would hay or grain, and preferably so the cows may eat while being milked. One of my neighbors who keeps about thirty head of stock tells me it is his invariable practice to give a feeding of silage the first thing in the morning, which is eaten while milking is going on. Then, when it is cleaned up, the racks are filled with dried hay, of which the cattle are given all they will eat. At night, the rest of the day's silage ration is given the same way, with some dry grain. This practice doesn't seem to injure the flavor of his butter. Anyway, it doesn't prevent his getting a fancy price for it in the most exacting market of the vicinity.

One objection to silage has some basis. That is, that its use obliges the dairyman to supply more bedding than otherwise. As there is seldom any waste to it, being usually eaten up absolutely clean, there is no coarse residue scattered back to serve for bedding. Unquestionably this causes rather more work. But most dairymen feel that forage is really worth more to feed than to make manure of, and that the extra good the animals get out of their cleanly eaten ration and the extra manure they themselves obtain from the extra bedding more than pay for the slight additional trouble involved.

ARGUMENTS IN FAVOR OF ITS USE.

Now, having thus run over some of the objections which have at various times been made against the use of silage, let us see what are some of the arguments for it. Here are ten points, condensed into single paragraphs by Expert Woodward of the Dairy division of the U. S. Department of Agriculture:

1. Silage is the best and cheapest form in which a succulent feed can be provided for winter use.

"2. An acre of corn can be placed in the silo at a cost not exceeding that of shocking, husking, grinding, and shredding.

"3. Crops can be put into the silo during weather that could not be utilized in making hay or curing fodder; in some localities this is an important consideration.

"4. A given amount of corn in the form of silage will produce more milk than the same amount when shocked and dried.

"5. There is less waste in feeding silage than in feeding fodder. Good silage properly fed is all consumed.

"6. Silage is very palatable.

"7. Silage, like other succulent feeds, has a beneficial effect upon the digestive organs.

"8. More stock can be kept on a given area of land when silage is the basis of the ration.

"9. On account of the smaller cost for labor, silage can be used for supplementing pastures more economically than can soiling crops, unless only a small amount of supplementary feed is required.

"10. Converting the corn crop into silage clears the land and leaves it ready for another crop sooner than if the corn is shocked and husked."

Some form of succulent feed has always been held essential to winter dairying. Years ago I have known farmers to raise acres of carrots or beets solely in order to have something fresh and juicy to "bait" the cows with and give them an appetite for their dry hay or stalks. In those days every farmer planted pumpkins with his corn to provide "messes" in the late fall and early winter. He also generally sowed turnips among the corn or potatoes, quite as often for the behoof of the cows as the sheep. Nor is there any doubt that these additions to the barn bill of fare were a great help. But in those days wages were comparatively low. As they run at present, the mere labor cost of raising enough roots for a sizable dairy would more than use all the possible profits from it. And, even at the best, roots can never make anything more than a small part of any ration, while silage, which is quite as succulent and vastly more nutritious, can be used for the larger part of the feed.

As to the cost of siloing an acre of corn it always will and always must differ very widely with differing conditions. Probably Expert Woodward is right in saying that, as a general rule, it won't cost any more to silo it than it would to shock, husk and stack it, and grind the grain and shred the stalks. Shredding, however, is not very widely done in New England. One of my dairying neighbors with a hundred-ton silo tells me he finds it costs him just about three times as much to silo an acre of corn as it does to dry and mow away an acre of grass.

Per contra, he gets about twelve tons of silage off the same acre that would yield him a ton and a half of dried hay. He used to feed an average of twenty-five pounds of hay per day per cow. That is, his ton and a half of hay would last ten cows twelve days. Now he feeds forty pounds of silage per day per cow. That is, his twelve tons of silage keep ten cows sixty days. While the acre, silaged, costs him about three times as much, it gives him five times as much feed, and this of a better quality. Taking the years together and his stock as they run, he finds, as a matter of practical experience, that he can keep just about three times as many head on the same acreage, with his silo, as he used to keep without it. Where he used to keep ten, he now keeps thirty, and finds that the thirty do better through the winter than the ten ever did; give more milk in proportion, make more butter, and come out in spring, in better condition.

This is a pretty vigorous confirmation from a practical dairyman's experience, of Expert Woodward's point No. 8, that "more stock can be kept on a given area of land when silage is the basis of the ration."

THE ORIGINAL SILO.

It is a curious illustration of the unexpected ways in which things develop to note that the original silo was just a hole-in-the-ground. From time immemorial farmers have sought means to carry crops into the winter which, but for some sort of protection, would decay and become worthless before they could be used. In this country, out-door pits or trenches for the storing of potatoes and other roots, cabbages, etc., have always been in more or less general use. In Europe, where stern necessity has always compelled from farmers greater attention to small economies than with us, not only have such things as roots and cabbages been preserved in pits, but apple pomace, grape leaves, turnip and beet tops and beet pulp from sugar factories used to be pitted when fresh and thus made to help out the winter rations of dry feed. In a work on agriculture, printed in this country so recently as 1882, I find full and detailed directions how to construct, fill and protect such earth pits. These pits, which were probably used more widely in France than anywhere else, were there called "silos." The word "ensilage" is also French and means simply to pack into a silo. In fact, the birth and early progress of our modern system of silage we owe to French farmers, more especially to one French farmer, M. Auguste Goffart of Burtin, near Versailles.

He, like other French farmers, was in the habit of using pits to preserve such crops as beets, artichokes, potatoes and turnips. In 1850 he began experimenting by ensilaging some wheat. Two years later he built four small underground silos of masonry trying in them cornstalks and straw as well as the other things. By their help he was enabled at least once to carry his full stock through a winter after the hay crop had failed entirely. But it wasn't till 1873 that he really began to get the idea of the modern silo. That season he had a simply enormous crop of corn and was so sore put to it for means of saving and utilizing his surplus that he determined to take a big chance. So he built him a triple silo, consisting of three chambers, each elliptical in form, and about forty feet long by twelve wide. They were sunk six and a half feet into the ground and carried ten feet above it; built of brick, waterproofed with Portland cement and roofed. In these, for the first time in the world's history, several hundred tons of fresh, green-cut cornstalks were fairly well preserved from October till the following March.

Three years later M. Goffart was given by the French government the decoration of the Legion of Honor.

THE MODERN SILO.

It still, however, required many years of experimentation and a good many failures before the silo reached such a degree of perfection and certainty as to become of universal practicability. For a long time it was thought advisable to make silos a good part below ground. It wasn't till after years of trial by hundreds of dairymen that the present system was found best, under which they are usually built wholly above ground, with only such excavation as is necessary to reach a solid, frost-proof foundation. M. Goffart at first used to mix half or more of cut straw with his corn, supposing this essential to its preservation. It was only when, being one year short of straw, he was compelled to silo the cut-up corn without it that he found his silage kept better than ever before. For years he covered the top of the silage with clay, stamped down into an air-tight seal; going over it every few days to re-seal the cracks and fissures appearing as the silage settled. Then he resorted to a heavily weighted cover of plank to settle with the silage and press it down. He found it necessary to use about half a ton of stones per square yard of surface to accomplish this.

That was about as far as he got in the adaptation of methods. Later experimenters found that, if the silage were cut into shorter lengths—half or three-quarters of an inch instead of the three or four inches which M. Goffart affected, and if, as siloed, it were kept well-tramped down, especially around the sides, it would keep even better than when weights were used. At first, too, the crop was often, either by chance or on purpose, allowed to dry out somewhat before being cut up and put in the silo. The best modern practice now prefers to have the stalks siloed about as soon as cut from the field—certainly within twenty-four hours of cutting. This usually obviates the use of water which frequently had to be applied under the old method of partial drying in large quantities. If, however, some necessity compels the use of partly dried stalks, it is still considered absolutely essential to add water as they are put in the silo. Experienced silage feeders say that there is much more danger, in such a case, of using too little than too much water. If an excess is hosed on that excess will find its way out before doing any damage, while there is no way of correcting the error, later, if too little has been put on.

The idea, developed from the facts of long and general experience, is that the nearer the silage can be preserved in its natural green and succulent condition, the better forage it will prove. The juices which are in the stalks and leaves when freshly cut are to be saved, if possible, as well as the fibre and solid matter. Of course, if anything has occurred to dry out some of these natural juices, another liquid must be substituted, i. e. water. But, at the best, water is only a makeshift and never can quite take the place of the plant's natural sap.

SILAGE MATERIALS.

After long tests in many countries by thousands of experimenters, our native Indian corn is agreed by all to make the best material for silage. Other plants and even some refuse matters may, however, be used and often turn out well. Sorghum is an excellent silage-maker. Its feeding value is about identical with that of corn silage, while its adherents claim that, if harvested when the seed has become hard, it will make a less acid and more palatable fodder than corn. Wherever the seasons are apt to be over-dry for corn, growing sorghum, by reason of its drought-resistant habit, is much relied upon.

Clover, also, makes a very valuable silage, especially high in protein content. When intended for such use it should be cut after some of the first heads are dead but while the mass is mostly in full bloom. As it does not pack so well as corn the need of chopping into short lengths and of persistent tramping down is even more imperative. Moreover clover, like all the other legumes such as alfalfa, cowpeas, soy beans, etc., gives to the silage a really objectionable odor, likely to taint the milk unless great care is used. Its lightness and "fluffiness" also make it essential that it should be used only in deep silos. It is not apt to keep in shallow ones.

Such other leguminous crops as have been mentioned can also be siloed, using the same precautions as with clover and bearing in mind that they are subject to the same objections.

In some sections of the country, the millets and vetches have been demonstrated to make good ensilage. In others such materials as corn-husks, pea-vines from the canning factories, beet-pulp from the beet-sugar works, have been used with more or less success.

But, as has been said, the best all-round crop for the larger part of this country, is common corn. As to just what varieties are most advisable, there is more room for debate. The department experts recommend the growing of whatever variety does best in any given locality—whatever would naturally be chosen for it on account of its ripening season and its grain-producing ability. Reason for this is found in the fact that the grain is the most valuable part of the plant. Analyses of the digestible matter in corn, for example, show that 63 per cent. of the digestible matter in average corn is found in the grain and only 37 per cent. in the stover. Therefore the experts also advise that corn should be cut for silage just at the same time as it would be harvested in the usual way, i. e. when the grain has ripened and the lower leaves turned brown. This advice is again based on analyses of the contents of corn plants at various stages of growth. The New York Experiment station has tested this matter out very fully. As a result it reports that an acre of corn weighing 18,045 pounds at the time of tasseling, yielded 16,426 pounds of water and 1,619 pounds of dry matter, i. e. food. Ten days later, when it had silked, an acre yielded 25,745 pounds, all told, of which 22,666 were water and 3,078 dry matter, i. e. food. Twelve days later yet, when the ears were "in the milk," an acre yielded 32,800 pounds, all told, of which 27,957 were water and 4,643 dry matter, i. e. food. Two weeks later, when the grain had begun to glaze, an acre yielded 32,295 pounds of total weight, of which 25,093 were water and 7,202 dry matter, i. e. food. Sixteen days latter, which brought the date to September 23, when the ears were fully ripe and fit for harvesting as grain, the total yield of an acre was 28,460 pounds of which 20,542 were water and 7,918 dry matter, i. e. food. In these cases it was perfectly clear that there was a steady gain in the amounting of food which the acre produced up to the time of ripening the ears. There was a loss of water between the dates when the kernels were in milk and when they were ripened of more than 7,000 pounds, but a gain of over 3,300 pounds in the actual food content.

And it is usually cheaper to get water from the pump or the brook than to raise it, even in the form of cornstalks!

But some dairymen do not find that these elaborately planned and carried out analysis absolutely agree with the facts of daily feeding experience. In the localities with which I am best acquainted the seasons are so short that only an early-ripening and therefore rather dwarf corn, with comparatively small stalkage, can be trusted to ripen ears. On the other hand some of the Leaming corns will produce a vastly greater weight of crop, though seldom maturing any ears. Several of my dairying neighbors raise this heavier-stalked variety, at least for a part of their crop. One of them, who knows a full milk-pail when he sees it and good butter when he tastes it, told me within a week that he wasn't able by any ordinary observation to see any difference in the amount or quality of his dairy's output when he reached that point in his silo where the immature Leaming silage took the place of the ripened stalks of matured grain. And an acre of the Leaming furnished him almost twice the weight he could get from an acre of native corn, cut when fully ripened.

This would seem to indicate that laboratory analysis are not always the final word in the determination of what a cow will do with her fodder. It isn't at all necessary to discredit their perfect accuracy—so far as they go. But we don't know, yet, all that goes on in a cow's insides while she is digesting her ration and turning it, some into hide and hair and horn and blood, some into suet, some into casein and some into butter-fat. When we know more we may learn that there are differences between her paunch and a test tube, and that she may get some thing quite worth while out of substances which the test tube discards as useless.

Probably the choice of any variety of corn to plant for silage might well be left to the decision of the individual farmer's judgment, based upon his own peculiar conditions and the results of his own practical trials. At the same time, chemical analysis furnishes an exceedingly valuable starting-point from which to conduct and on which to base individual experiments. Therefore the following table from Henry's "Feeds and Feeding," is well worth preserving and using. It shows the digestible nutrients found by analysis in a hundred pounds of various kinds of succulent—not dried—forage:

Corn.	Total dry matter.	Digestible dry matter.—Protein	Carbohydrates.	Fat.
	Pounds.	Pounds.	Pounds.	Pounds.
Green fodder corn....	20.7	1.0	12.2	0.4
Corn silage	26.4	1.4	14.2	.7
Green sorghum fodder.	20.6	.6	11.6	.3
Sorghum silage	23.9	.1	13.5	.2
Uucured red clover ...	29.2	2.9	13.6	.7
Clover silage	28.0	1.5	9.2	.5
Uncured soy-bean	24.9	3.1	11.0	.5
Soy-bean silage	26.8	2.7	9.6	1.3
Uncured cowpeas	16.4	1.8	8.7	.2
Cowpea vine silage	20.7	1.5	8.6	.9
Pasture grass	20.0	2.5	10.1	.5
Oats and peas (uncured)	20.3	1.8	10.2	.4
Mangels	9.1	1.0	5.5	.2
Sugar beets	13.5	1.2	9.8	.1
Sugar-beet pulp (wet).	10.2	.5	7.7	...

From this table it will be seen that corn silage ranks even higher than green fooder corn in everyone of the three constituents of nutrition—protein—carbohydrates and fat. Doubtless this curious fact is due to the presence of more grain in the silage than is apt to be found in fodder corn—a crop usually sown thickly and cut before any ears have even formed on it.

It must not be assumed that siloing corn adds anything to its feeding value...Quite the opposite. There is always some loss in the process. Fermentation always takes place, the extent of it depending solely on the amount of air in the silo. There will be fermentation just as long as there is any oxygen to feed it. Therefore, the deeper the silo and the greater the consequent pressure settling its contents together and squeezing the air out, the less will be the fermentation. Such tests as have been made indicate that in modern deep, well-filled silos, the loss due to fermentation and all other causes should not exceed ten per cent. This is vastly less than is lost by field curing of stover. "More food material can be saved by putting the corn crop into the silo than by harvesting and storing it in any other way."

The preceding table also shows clearly why silage needs to be supplemented by the addition of small amounts of other feeds richer than it is in protein. Fed alone, it makes too "wide" a ration. It is to be classed as "roughage" and fed accordingly.

THE MAKING AND FEEDING OF SILAGE.

I quote from Woodward on "The Making and Feeding of Silage:"

"In feeding cattle it is quite important that the ration include some succulent material, such as fresh grass, root crops, or silage. A feed containing a large amount of water in the form of natural plant juices is not only more easily digested but is also more palatable and, besides, serves the useful purpose of keeping the whole system of the animal in good condition. A silage-fed animal is rarely troubled with constipation or other digestive disturbances, the coat is noticeably sleek and soft, and the skin is soft and pliable. It is a well-known fact that a cow usually reaches her maximum production when she has access to a good pasture. The best and cheapest substitute for fresh pasture grass during the fall and winter is silage.

"No rough feed is more palatable than good corn silage. Sometimes, however, a cow will not eat silage readily until she has acquired a taste for it; this may require several days. But silage is not peculiar in this respect, for it has been observed that range horses or cattle shipped into the corn belt refuse corn the first time it is offered to them. The quality of palatability is of great importance, as it induces a large consumption and stimulates the secretion of digestive juices."

When a dairyman makes up his mind to have a silo, he is confronted with the question, What kind? There are brick silos and stone silos and stave silos and concrete silos and silos known as the Iowa and the modified Wisconsin types.

Brick and stone silos are generally satisfactory, but in most cases they are so much more expensive than other forms that they need hardly be considered.

The Iowa silo is constructed of hollow tile blocks reinforced with steel. The air spaces in the hollow tile are believed to afford some protection against freezing. But this, also, is a somewhat costly form. And the need of protection against freezing is not great. Silos in my neighborhood, even when of thinnest stave construction, seldom freeze, if roofed, except in the severest below-zero weather, and then only around the outer edges. Nor does this sort of skin-freezing seem to injure the silage in the least.

The modified Wisconsin silo is built of strips horizontally nailed around the inside of a circle of upright studs. Owing to the difficulty of bending this sheathing a silo of this type must have rather large diameter. It is said that one less than 14 feet in diameter is "very hard to build." On the other hand it requires no hoops or lugs, is very substantial, is not liable to be blown down or to dry out, and can be more easily repaired if some boards rot out.

The stave silo is the commonest of all forms, because it is cheap and can be set up with ease and speed. At the same time it has the shortest life and is "more liable to blow down, fall down or otherwise get out of repair than either of the other type of silos." Its life is from five to fifteen years depending on the lumber, the care used in construction, the climate, etc.

The concrete silo is permanent and stable, will neither blow down, burn down, rot out nor admit vermin. One will outlast its builder. Repairs are reduced to a negligible amount. The only cost is the first cost. This is greater, however, than any form of wood silo. In some cases where lumber is especially dear and materials for concrete are peculiarly cheap and easy to get, the difference may not be very great. So far as statistics in regard to cost are available they indicate that the first cost of a concrete silo averages about $2.58 per ton of its capacity, while the stave silo averages about $1.63 per ton capacity.

There are at least four essentials which must be looked after, whatever form is chosen.

The walls must be made and kept air-tight. Otherwise fermentation will continue to spoil the contents so long as air can reach them.

The inside of the walls must be plumb and smooth so the silage will slip easily down them as it settles and thus prevent the formation of air spaces. This makes the fitting of the doors a rather petnickety job.

The silo must be deep enough so that the pressure of the silage itself will insure solid packing and exclusion of air.

It must be round in shape because this form is cheapest, gives most rigid walls and asures better preservation of the contents.

(Continued on Page Nine)